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Manual CUBE20S Expansion

Analog input modules incl. base
AI 4x16 Bit 0 (4) ... 20 mA

This document is valid for the following products:

Name	Art. no.
CUBE20S system	57262
AI 4x16 Bit 0 (4) ... 20 mA	
Analog input modules incl. base	

Status

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1 Introduction

1.1 Service and support

Sales	Our sales staff in the company, field service and technicians will support you at all times.
CONNECTIVITY system consultants	Our system consultants are your competent contact persons when you want to develop CONNECTIVITY solutions. Together with you, they find the optimum solutions for your electrical installations. Our CONNECTIVITY consultants find ways that help you to permanently improve the competitiveness of your machines and plants.
Customer Service Center (CSC)	Our staff of the Customer Service Center will help you with all questions concerning installation and set-up. They support you, for example, if you have problems when combining hardware and software products of different manufacturers. There are numerous support tools and possibilities for measurements - both for fieldbus systems and electromagnetic interference. Please do not hesitate to call us on +49 (0) 7191 47-2050 or send us an e-mail to: csc@murrelektronik.de.
Service addresses	Please see our website for your contact person: www.murrelektronik.com

1.2 Introduction / about this document

Function of this document

This document describes the use of the module
AI 4x16 Bit 0 (4) ... 20 mA
from the Cube20S system of Murrelektronik GmbH. It includes a description of the design, engineering and application.

1.3 Symbols

This document includes information and notes that have to be observed for your own safety and to avoid personal and material damage. They are characterized as follows:



DANGER!

Immediate danger

→ Failure to observe this warning involves an imminent risk of death or serious injuries!



WARNING!

Possible danger

→ Failure to observe this warning may cause death or serious injuries.



CAUTION!

Low-risk danger

→ Failure to observe this warning causes minor to moderate injuries.

NOTICE

Risk of material damage

→ Failure to observe this warning causes material damage.



NOTE

Other technical information and notes of Murrelektronik GmbH.



RECOMMENDATION

Notes with this symbol are recommendations of Murrelektronik GmbH.

Instruction for use

- An arrow marks instructions for use.
- Read and observe the instructions for use.
- 1 | If they are numbered, it is absolutely necessary to follow them in the correct order.
- 2 | Read and observe the instructions for use.

1.4 Trademarks

The trademarks of the following companies are used in this documentation:

Adobe Systems Corp.	Adobe Acrobat Reader
Microsoft Corp.	Microsoft Windows 7, Windows Vista, Windows 2000, Windows XE/XP and Mi- crosoft Internet Explorer
PROFIBUS International (P.I.)	PROFIBUS, PROFIBUS DP
PROFIBUS / PROFINET International (P.I.)	PROFINET, PROFINET IO
ODVA Open DeviceNet Vendor Association	EtherNet/IP
EtherCAT® und TwinCAT®	Registered trademark of the Beckhoff Automation GmbH
CAN in AUTOMATION - International Us- ers and Manufacturers Group e.V.	CANopen
Gould Inc. Corporation	Modbus
Siemens AG	S5-200, S5-300, S5-400 S7-200, S7-300, S7-400

2 For your own safety

2.1 Target group

Users	This manual is intended for users who have knowledge of automation systems.
Documentation	Please give this manual to all employees involved in the following tasks: ■ Planning ■ Installation ■ Set-up ■ Operation

2.2 Intended purpose

Designated use	The Cube20S system has been designed and manufactured for: ■ communication and process control ■ general control and automation tasks ■ industrial use ■ operation under the ambient conditions specified under technical data ■ installation in a switch cabinet
Foreseeable misuse	The device is not approved for being used: ■ in potentially explosive atmospheres (EX Zone) ■ outside of switch cabinets.

2.3 General safety instructions

Please observe:

- the relevant safety and accident prevention regulations;
- the EC Directives or other national regulations;
- generally recognized safety rules;
- the section "**Installation guidelines**".

NOTICE

Defective device!

Improper use of the hardware and software can cause damage to the device.

- Only qualified personnel of Murrelektronik GmbH may manipulate the device.
- Only use the device to the extent described in the manual.

Avoid accidents caused by electrical voltage!

- Disconnect the device from the mains.
- Then carry out installation or repair work.

Avoid personal and material damaged caused by malfunctions!

- Provide external circuit breakers.
- The device may only be operated within the specified tolerances.

Avoid undefined states!

- Select and install connection lines so that capacitive and inductive interference does not have adverse effects on the system.
- Protect the device against improper and accidental use.

2.4 Notes on electrostatically sensitive equipment

NOTICE**Overvoltage due to electrostatic discharge!**

The assemblies might get damaged.

- Ensure sufficient grounding of persons and working material!

Handling

Murrelektronik assemblies include highly integrated MOS components. These components are extremely sensitive to over-voltages occurring, for example, due to electrostatic discharge. Assemblies at risk are marked by the adjacent symbol.

The symbol is fixed to assemblies, sub-racks or packaging and indicates electrostatically sensitive equipment. These assemblies may become irreparably damaged by voltage and energy levels which are far below the perception levels of human beings.

If a person who is not electrostatically discharged handles electrostatically sensitive equipment, voltages may be produced. They may damage components, impair the functioning of the assemblies or render the assembly inoperative. Frequently, assemblies damaged like this cannot directly be recognized as faulty. The fault may show only after longer operation.

Components damaged by electrostatic discharge may produce temporary faults in case of temperature changes, vibrations or load changes.

Only with a consistent use of protective devices and a responsible compliance of the instructions for use can you avoid malfunctions or failures of the electrostatically sensitive equipment.

Shipping

- For shipping electrostatically sensitive equipment, use **always** the original packaging.

Measurements

Observe the following notes for measurements on electrostatically sensitive equipment:

- Discharge potential-free measuring instrument briefly.
→ Ground the measuring instruments used.

2.5 EMC installation guidelines

Industrial use

The CUBE20S system is an electronic device manufactured according to the current state-of-the-art standards. Both the robust mechanical construction and the design of the electronic components make it ideal for industrial use.

To guarantee a trouble-free operation, observe the following rules when installing the device in systems. Otherwise, the high interference immunity and resistance to damage of the device may become partially ineffective.

The interference immunity of the entire system considerably depends on the correct installation, location and wiring.

- 1 | For safe operation, check the installation regulations stipulated by the manufacturer of the controller.
- 2 | Bring them in line with the recommendations for an EMC-compatible design.
- 3 | Then install CUBE20S system.

2.6 Notes on spare parts and accessories

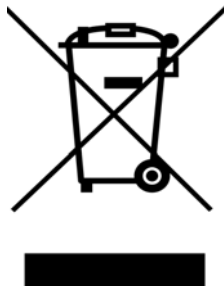
Spare parts

- Only use original spare parts or spare parts by other manufacturers expressly authorized by Murrelektronik GmbH.
- Check the function of the device after having replaced a part.

Accessories

- The use of accessories may alter the device function. Use only accessories authorized by Murrelektronik GmbH.
- Please note the instructions of the accessories when installing them.

2.7 Environmentally friendly disposal



Disposal

Do not throw electrical devices, batteries or accumulators in the domestic waste!

If you want to dispose of the product, it may be returned free of charge to Murrelektronik GmbH. This is also valid for original packaging and batteries or accumulators.

Return

- ➔ Label the product and the packaging with **"For disposal"**.
- ➔ Pack the product.
- ➔ Send the package to:
Murrelektronik GmbH
Falkenstraße 3
D-71570 Oppenweiler

We ensure that it is disposed of according to the German legislation. Transport to the place of destination is at the expense of the last owner.

2.8 EC Declaration of Conformity



Murrelektronik GmbH herewith declares that the products and systems comply with the basic requirements and other relevant regulations of the following Directives:

- 2004/108/EC Electromagnetic compatibility
- 2006/95/EC Low voltage
- 2011/65/EU RoHS

2.9 Warranty and liability

Warranty and liability claims

Warranty and liability claims shall be lost if

- the product is not used according to its designated use,
- damage is caused because the manual and the operating instructions have not been observed,
- the staff was/is not qualified.

3 Description

3.1 System

Overview

The Cube20S system is a modular automation system mounted on a 35 mm DIN rail. Using 2, 4 and 8-channel expansion modules, you may adapt this system perfectly to your automation tasks.

You do not need much wiring because the 24 V DC power supply is integrated in the backplane bus. Defective electronic modules can be replaced without having to replace the wiring.

Using power modules with different colors, you may define further voltage ranges for the 24 V DC power supply within the system or add 2 A to the electronic supply.

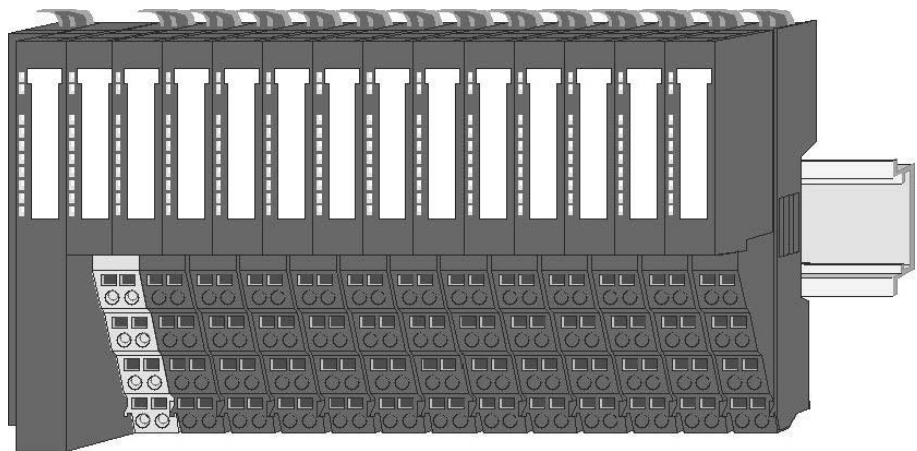


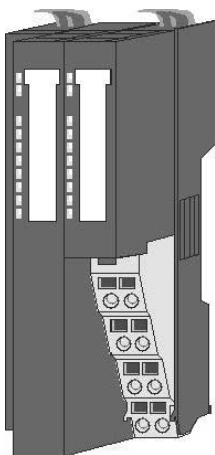
Fig. 3-1: Cube20S system

Components

The Cube20S system consists of the following components:

- Bus node
- Expansion modules
- Power modules
- Accessories

Bus node



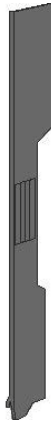
Bus interface and power module of the bus node are incorporated in one housing. The bus interface is used to connect to a parent bus system.

Both bus interface and the electronics of the connected expansion modules are supplied with power over the power module.

There is another connection on the power module for the 24 V DC power supply of the connected expansion modules.

By installing up to 64 expansion modules on the bus node, they will be electrically connected, i.e.

- they are incorporated in the backplane bus,
- the electronic modules are supplied with power,
- each expansion module is connected to the 24 V DC power supply.

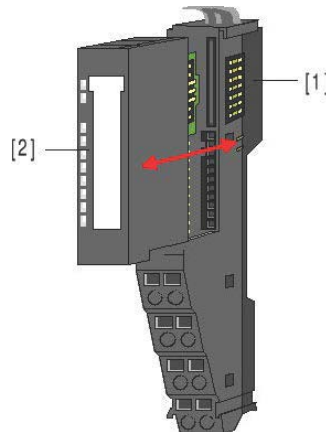
Bus cover

Each bus coupler has a cover to protect the contacts.

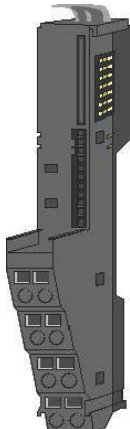
- ➔ Remove the cover on the bus node before installing Cube20S modules.
- ➔ To protect the contacts, mount the bus cover on the outmost module.

Expansion modules

Each expansion module consists of a terminal and an electronic module.



- 1 Terminal module
- 2 Electronic module

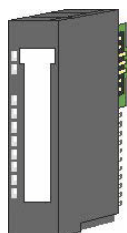
Terminal module

The terminal module consists of the following functional elements:

- a sliding mechanism to fasten the electronic module,
- the backplane bus with power supply for the electronics,
- the connection to the 24 V DC power supply,
- the staircase-shaped terminal block for wiring.

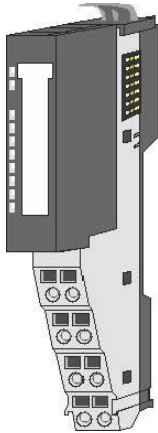
In addition, the terminal module possesses a safe locking system for fastening on a mounting rail.

This locking mechanism allows you to mount your Cube20S system outside the switch cabinet and fix the complete system later in the switch cabinet.

Electronic module

The functionality of an expansion module is defined over the electronic module.

- If the electronic module is defective, it can be replaced while wiring is kept.
- On its front, there are LEDs indicating the status.
- For an easier wiring, there are wiring diagrams on the front and side of each electronic module.

Power modules

Power modules provide the Cube20S system with power. The power modules are either integrated in the bus node or may be plugged between the expansion module.

Depending on the type of power module, groups of potential can be defined for the 24 V DC power supply, or the electronics supply may be extended by 2 A.

For a better recognition, the power modules have a different color than the expansion modules.

3.2 Dimensions

Dimensions of the bus node

Fig. 3-2: Dimensions of the bus node

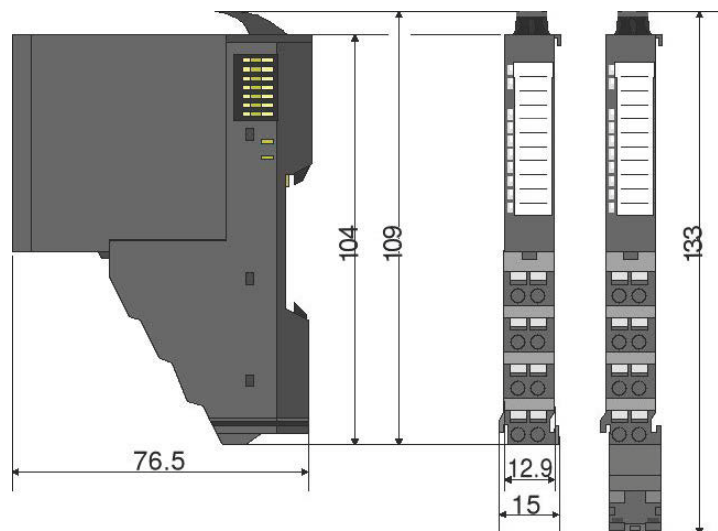
Dimensions of the expansion module

Fig. 3-3: Dimensions of the expansion module

Dimensions of the electronic module

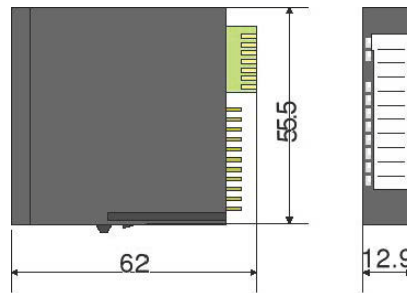


Fig. 3-4: Dimensions of the electronic module

3.3 Mounting



NOTE

You can mount the modules individually or as a whole block on the DIN rail. For block installation, please observe the following: **All** locking levers must be open.

3.3.1 General notes

The individual modules are mounted directly on a DIN rail. Electronics and power supply are connected over the backplane bus.

Conditions:

- Max. number of plug-in modules: 64
- Max. total current of the electronics supply: 3 A

A **power module sensor/actuator/bus art. no. 57131** amplifies the current for the electronics supply by 2 A. For details, please see section **Wiring**.

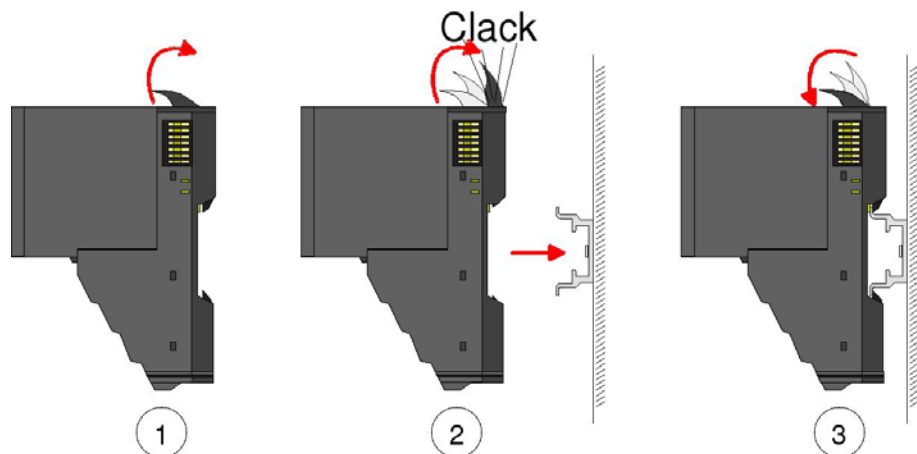


Fig. 3-5: Installing the module

3.3.2 Functional principle of the locking

Inserting and locking the module

- ✂ The terminal module has a locking lever at its top.
- 1 | For installation and disassembly, please press this lever upwards until it engages audibly.
- 2 | Plug the module to be mounted in the previously plugged-in module.

3 | Slide the module with the help of the guide strips at top and bottom onto the DIN rail.

4 | Flap the locking lever downwards.

The module is fastened to the DIN rail.

3.3.3 Replacing an electronic module

Disassembly

✓ The electronic module has a locking lever at the bottom.

1 | Press the locking lever upwards for disassembly.

2 | To remove the electronic module, pull it out towards the front.

The electronic module has been removed.

Installation

✓ The electronic module has a locking lever at the bottom.

➔ Slide the electronic module with the help of the guide strip into the terminal module.

The electronic module engages audibly at the bottom.

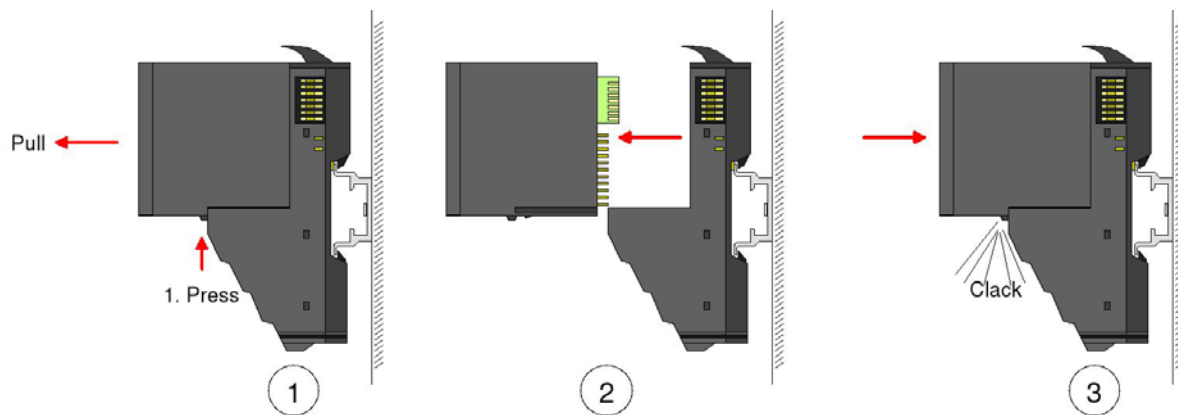


Fig. 3-6: Disassembling and installing the electronic module

3.3.4 Installing the DIN rail

➔ Install the DIN rail with the necessary distances (see Fig. 3-7: "Installation distances").

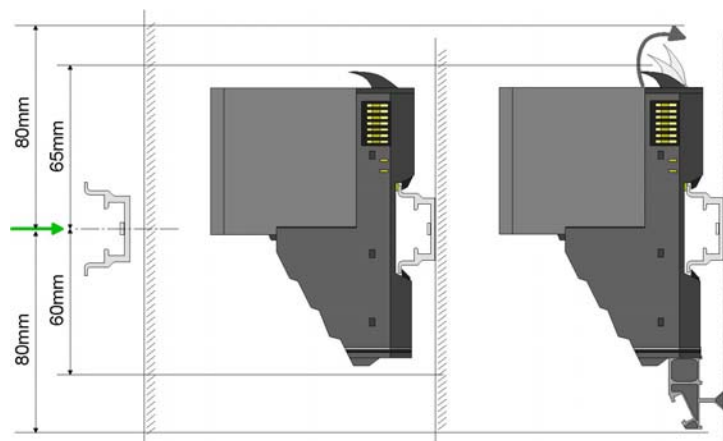


Fig. 3-7: Installation distances

3.3.5 Installing the bus node

- ✓ To mount the system, start on the left with the bus node.
- 1 | Flap the two locking levers of the bus node upwards.
- 2 | Plug the bus node in the DIN rail.
- 3 | Flap the two locking levers of the bus node downwards.
- 4 | To remove the right bus cover, pull it out towards the front.
- 5 | Store the bus cover to use it as termination of the system.

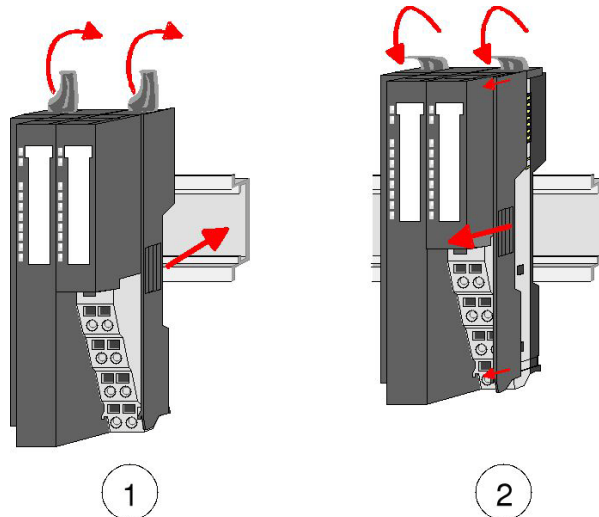


Fig. 3-8: Installing the bus node

3.3.6 Installing the expansion modules

- 1 | Flap the locking lever of the expansion module upwards.
- 2 | Plug the expansion module in the DIN rail.
- 3 | Push the expansion module towards the bus node or the last expansion module.
- 4 | Flap the locking lever of the expansion module downwards.
- 5 | Mount all expansion modules as described.

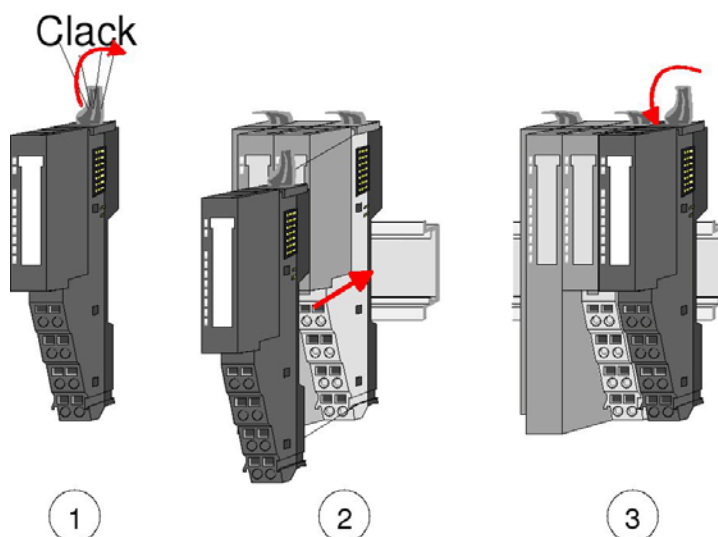


Fig. 3-9: Installing the expansion module

3.3.7 Installing the bus cover

- ✓ Prerequisite: The system has been completely mounted.
- ➔ Plug the bus cover in the outmost module as a protection of the bus contacts.

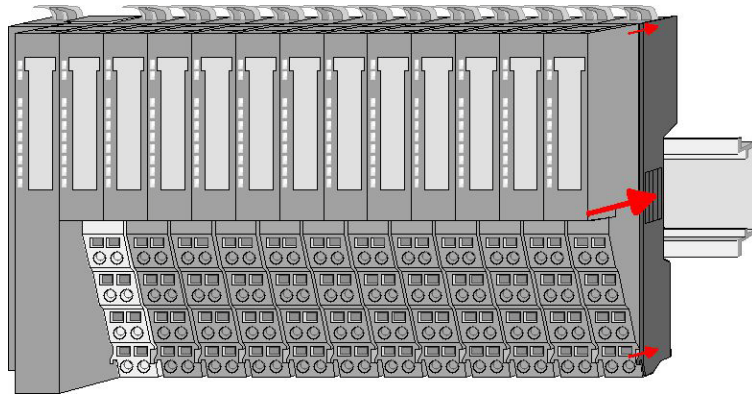


Fig. 3-10: Installing the bus cover

3.4 Disassembling and replacing modules

3.4.1 Procedure

During disassembly or when replacing a module or module group, please observe the following:

- 1 | Remove the electronic module to the right of the module or module group.
- 2 | Dismount/replace the module or module group.
- 3 | Plug in the electronic module.

3.4.2 Replacing an electronic module

Disassembly

- ✓ The electronic module has a locking lever at the bottom.
- 1 | Press the locking lever upwards for disassembly.
- 2 | To remove the electronic module, pull it out towards the front.

The electronic module has been removed.

Installation

- ✓ The electronic module has a locking lever at the bottom.
- ➔ Slide the electronic module with the help of the guide strip into the terminal module.

The electronic module engages audibly at the bottom.

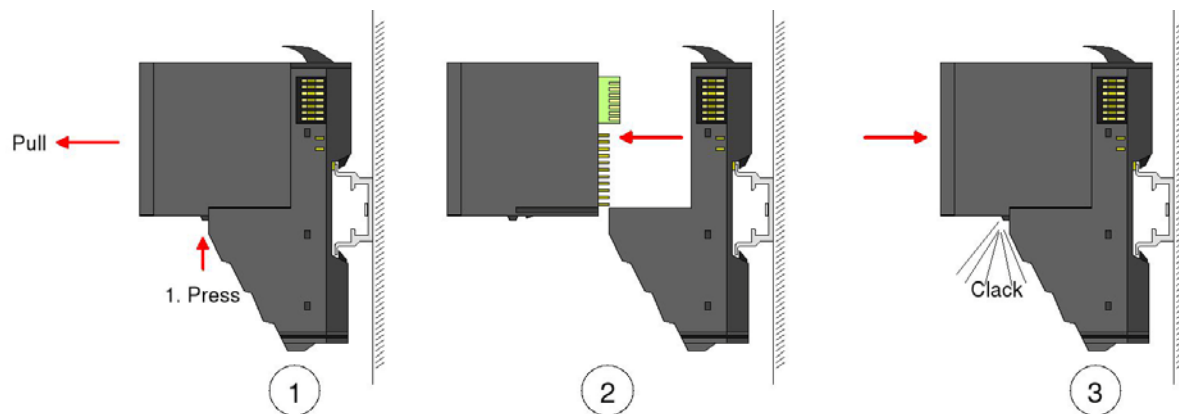


Fig. 3-11: Disassembling and installing the electronic module

3.4.3 Replacing a module

Disassembly

- 1 | Remove the wiring from the module, if any. For details, please see section **Wiring**.
- 2 | Unlock the electronic module to its right at the bottom.
- 3 | To remove the electronic module, pull it out towards the front.
- 4 | Flap the locking lever of the module to be replaced upwards.
- 5 | To remove the module, pull it out towards the front.
- 6 | Plug in the electronic module again after installation.

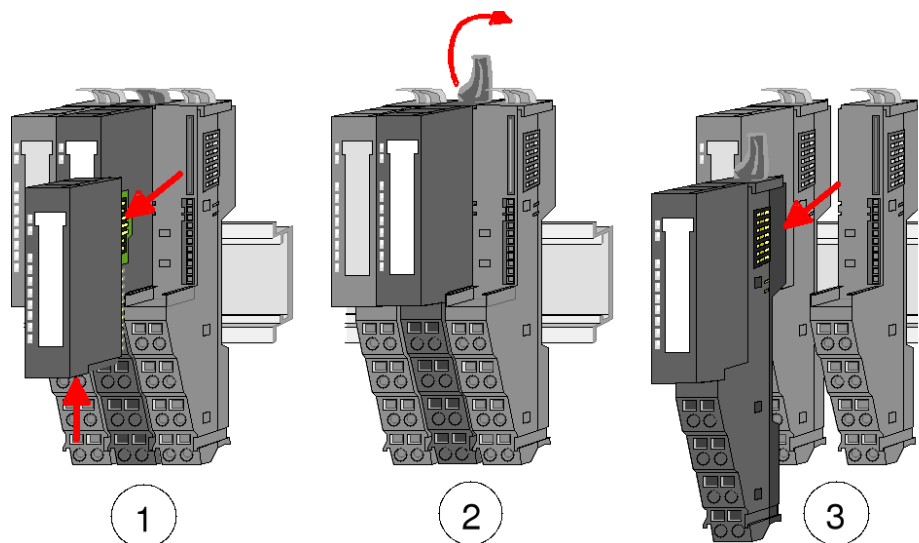


Fig. 3-12: Disassembling a module

Installing the new module

- 1 | Flap the locking lever of the module upwards.
- 2 | Plug the module in the gap between the modules.
- 3 | Slide the module with the help of the guide strips at both sides onto the DIN rail.
- 4 | Flap the locking lever of the module downwards.
- 5 | Plug in the electronic module.

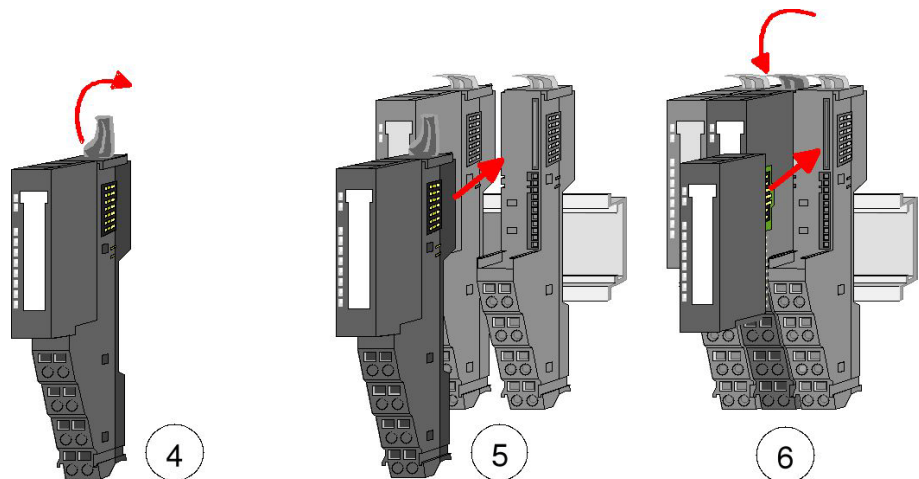


Fig. 3-13: Installing the new module

3.4.4 Replacing a bus node

Disassembly



CAUTION!

Power module and bus interface belong together!

If separated, the modules get destroyed.

→ Do not separate power module and bus interface!

- 1 | Remove the wiring from the bus node, if any. For details, please see section **Wiring**.
- 2 | Unlock the electronic module to its right at the bottom.
- 3 | To remove the electronic module, pull it out towards the front.
- 4 | Flap the locking lever of the bus node upwards.
- 5 | To remove the bus node, pull it out towards the front.

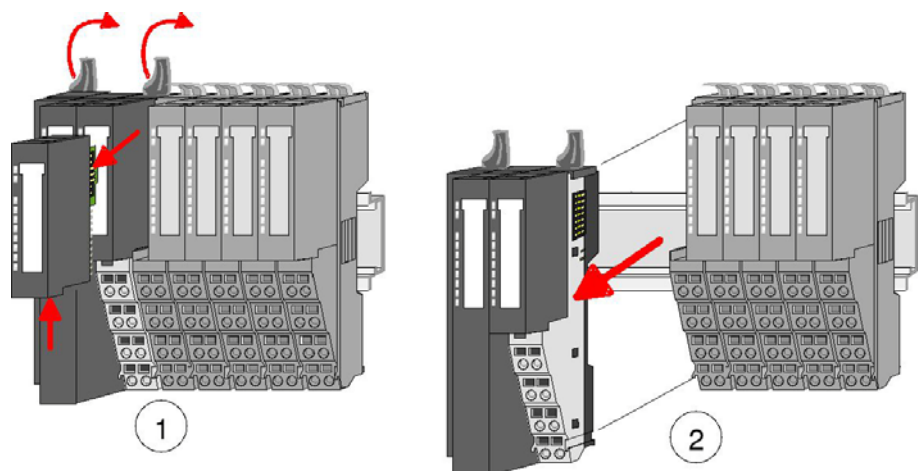


Fig. 3-14: Disassembling the bus node

Installing the new bus node

- 1 | Flap the locking levers of the bus node upwards.
- 2 | Plug the bus node in the left module.
- 3 | Slide the bus node with the help of the guide strips onto the DIN rail.

- 4 | Flap the locking levers downwards.
- 5 | Plug in the electronic module.

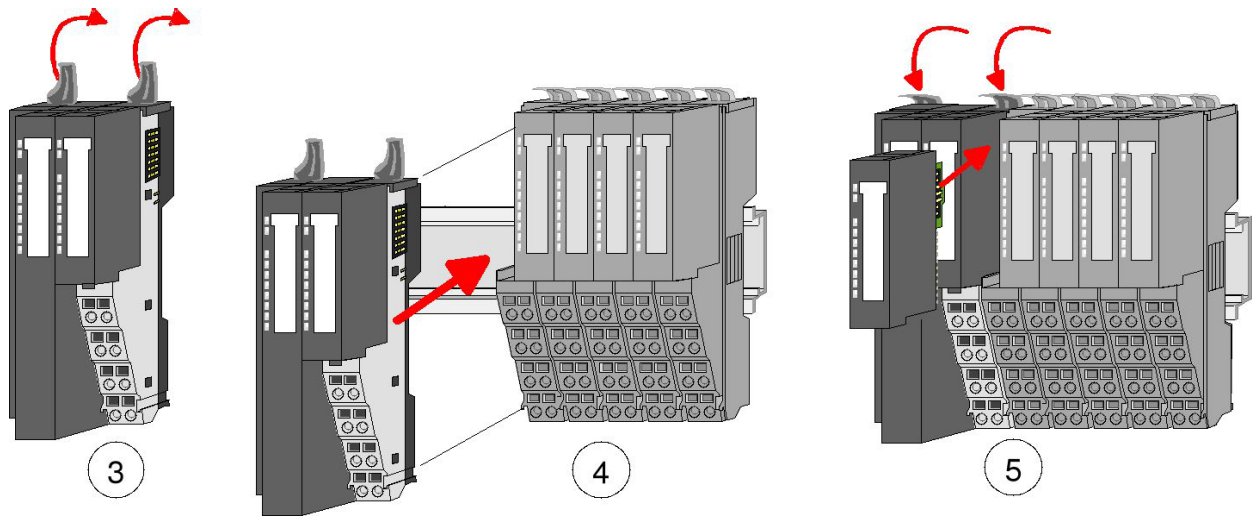


Fig. 3-15: Installing the new bus node

3.4.5 Replacing a module group

Disassembly

- 1 | Remove the wiring from the module group, if any. For details, please see section **Wiring**.
- 2 | Unlock the electronic module to its right at the bottom.
- 3 | To remove the electronic module, pull it out towards the front.
- 4 | Flap the locking levers of the module group upwards.
- 5 | To remove the module group, pull it out towards the front.

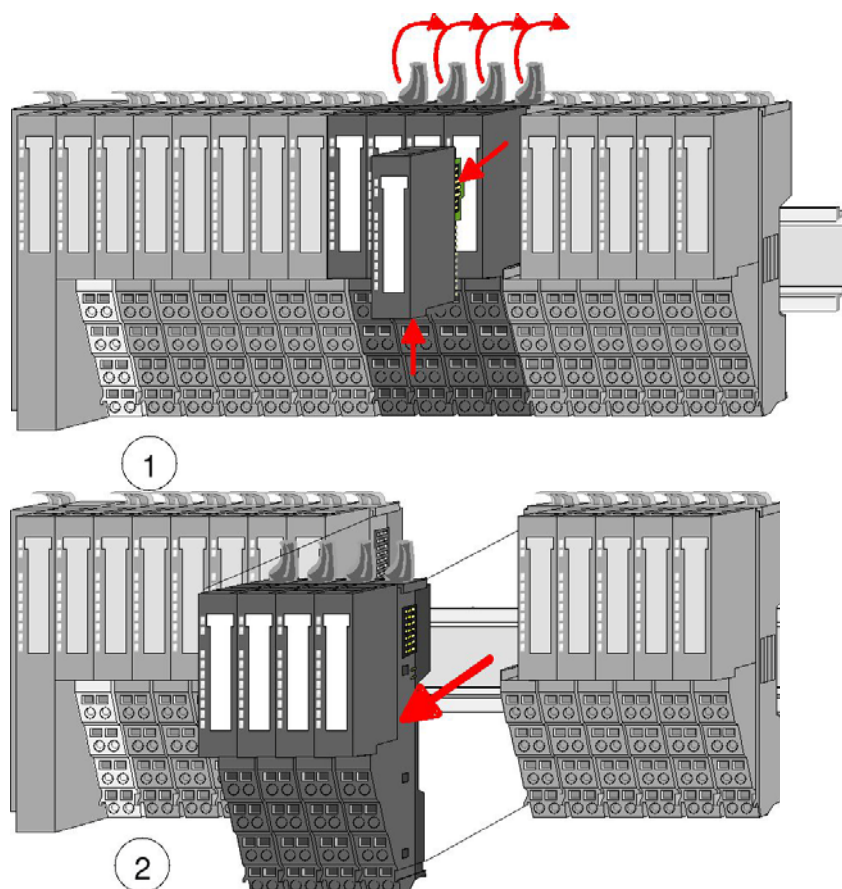


Fig. 3-16: Disassembling the module group

Installing the new module group

- 1 | Flap the locking levers of the module group upwards.
- 2 | Plug the module group in the gap between the modules.
- 3 | Slide the module group with the help of the guide strips at both sides onto the DIN rail.
- 4 | Flap the locking levers of the module group downwards.
- 5 | Plug in the electronic module.

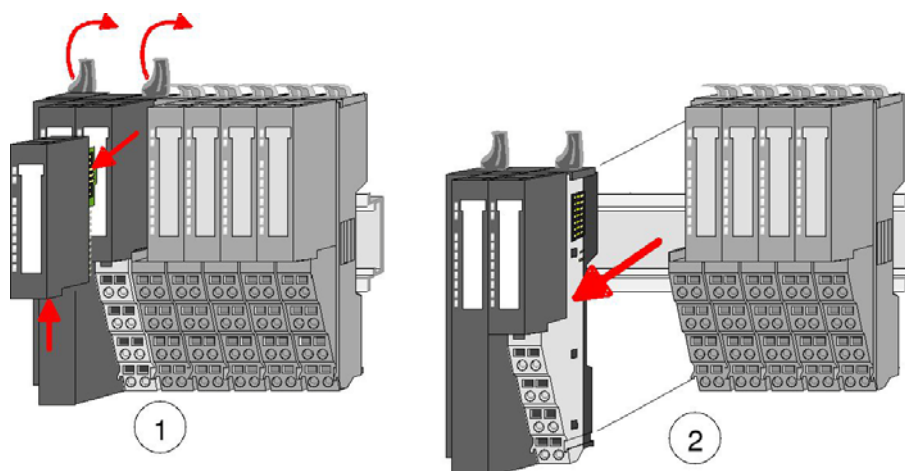


Fig. 3-17: Disassembling the bus node

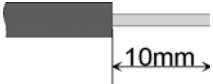
3.5 Wiring

3.5.1 Spring terminals

Terminals

Spring terminals are used for wiring. Spring terminals allow you to connect the signaling lines and power cables fast and easily. This type of connection is resistant to vibrations.

Cable data



$U_{\text{max.}}$: 240 V AC / 30 V DC
 $I_{\text{max.}}$: 10 A
Cross section: 0.08 ... 1.5 mm² (AWG 28 ... 16)
Stripping length: 10 mm

3.5.2 Procedure

Wiring

✂ Tools: suitable screwdriver

✂ Wire cross-section: 0.08 mm² ... 1.5 mm²

- 1 | Put the screwdriver slightly inclined in the rectangular opening (Fig. 3-18: 1).
- 2 | Press and hold the screwdriver away from the round opening. The contact spring is open (Fig. 3-18: 2).
- 3 | Put the stripped wire in the round opening (Fig. 3-18: 2).
- 4 | Remove the screwdriver (Fig. 3-18: 3).

The wire is securely connected with the terminal by means of a spring contact.

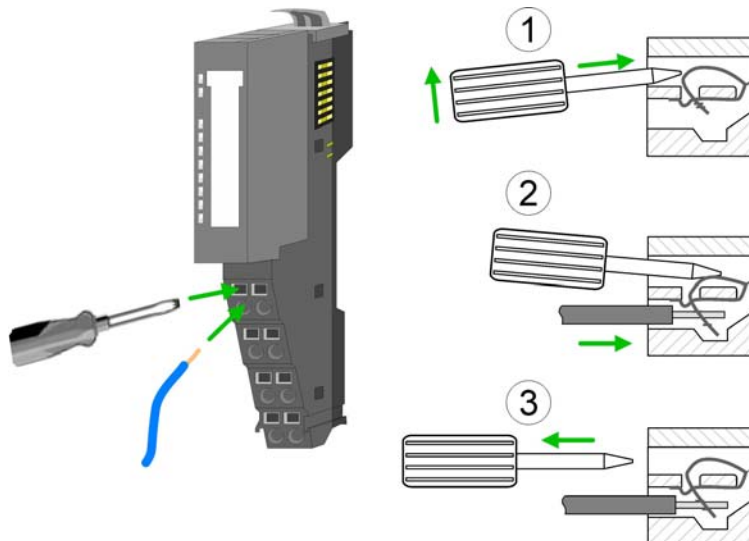


Fig. 3-18: Spring terminals

3.5.3 Standard wiring

Standard wiring

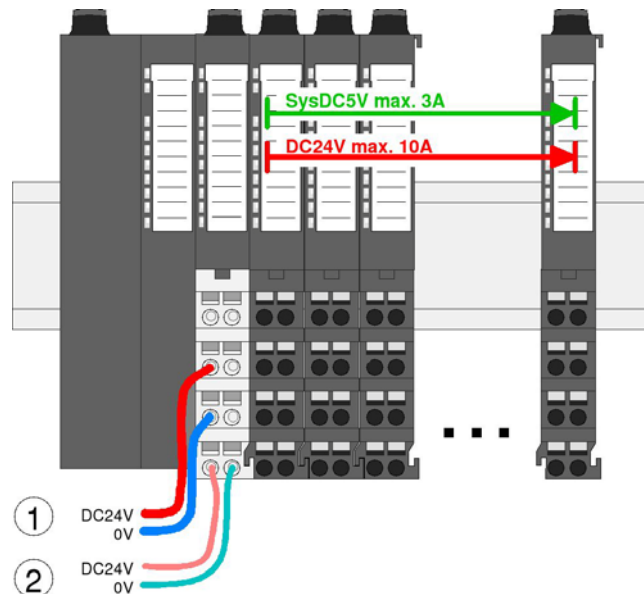


Fig. 3-19: Standard wiring

- 1 24 V DC for power supply of I/O level (max. 10 A)
- 2 24 V DC for electronics supply, bus node and I/O level

3.5.4 Fuse protection



WARNING!

The power supply is not protected internally.

It can get destroyed by too high currents.

→ Protect the power supply externally using a fuse or line circuit breaker!



NOTE

The electronics supply is internally protected against too high voltages by means of a fuse. The fuse is located inside the power module. After the fuse has tripped, the electronic module has to be replaced!

External fuse

To protect the power supply, Murrelektronik provides a number of circuit breakers. They can be found under the product name **MICO** on the internet (www.murrelektronik.com).

3.5.5 Using power modules

Status of the electronics power supply

After switching on Cube20S, the RUN or MF LED lights up at every module. If the total current for the electronics supply exceeds 3 A, the LEDs are not activated. In this case, plug in the power module, art. no. 57130, between the expansion modules.



NOTE

To guarantee power supply, the power modules can be used in any combination.

Power module art. no. 57130

Use this power module if

- 10 A are not longer enough for power supply
- you want to have groups of different potentials

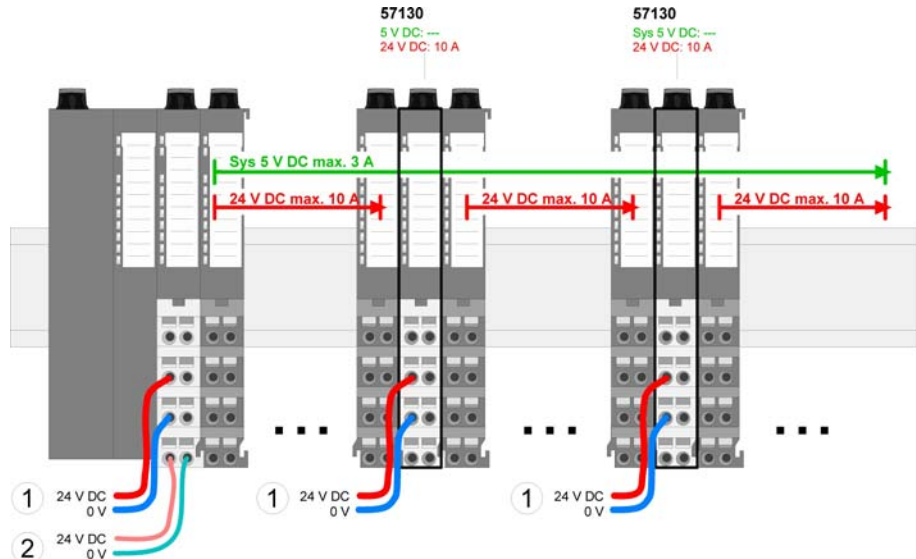


Fig. 3-20: Power module art. no. 57130

- 1 24 V DC for power supply of I/O level (max. 10 A)
- 2 24 V DC for electronics supply, bus coupler and I/O level

Power module art. no. 57131

Use this power module if 3 A are not enough for electronics supply on backplane bus.

In addition, you will have a new group of potential for 24 V DC power supply with max. 4 A.

Using a power module, you can plug in modules with a maximum total current of 2 A in the following backplane bus. Then you have to plug in another power module.

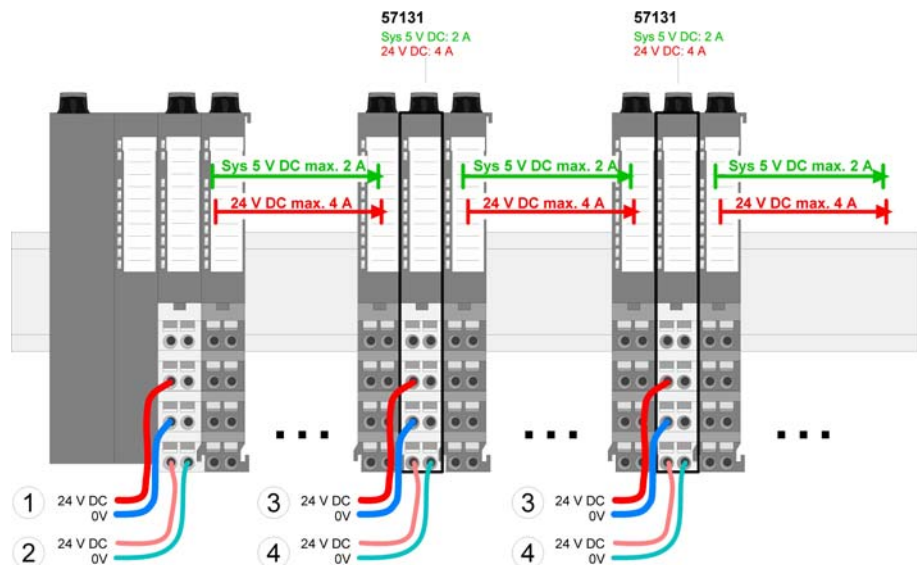


Fig. 3-21: Power module art. no. 57131

- 1 24 V DC for power supply of I/O level (max. 10 A)
- 2 24 V DC for electronics supply, bus coupler and I/O level
- 3 24 V DC for power supply of I/O level (max. 4 A)
- 4 24 V DC for electronics supply, I/O level

3.5.6 Fixing the shield



Fixing the shield

NOTE

Shield bus carriers are required for installing a shield (see **Accessories**).

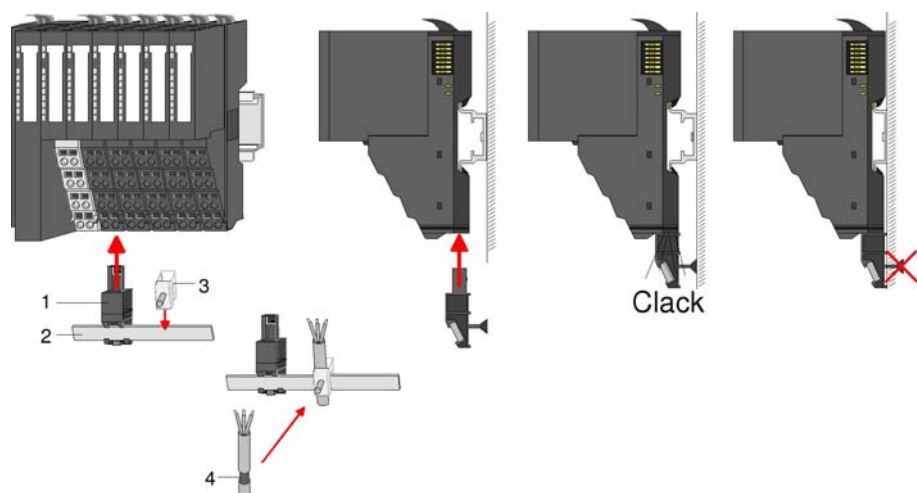


Fig. 3-22: Fixing the shield

- 1 Shield bus carrier
- 2 Shield bus (10 mm x 3 mm)
- 3 Shield terminal block
- 4 Shielding

Fixing the shielding

- ✓ The shield bus carrier and the shield bus have been plugged in.
- ➔ Fasten the lines with the stripped shield.
- ➔ Connect the shield terminal blocks to the shield bus.

3.6 Troubleshooting - LEDs

General information

Each module has two LEDs on the front: **RUN** and **MF**. These LEDs allow you to detect errors in your system or faulty modules.

Designation	Indication	LED status
RUN LED		off
		green
		flashing green
MF LED		off
		red
		flashing red

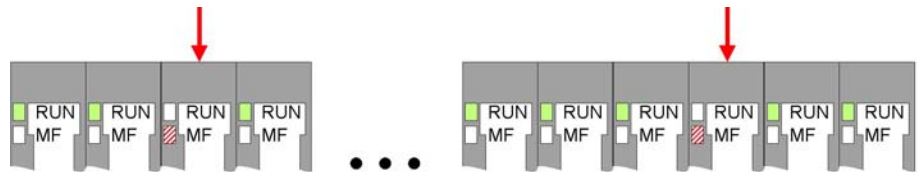
Tab. 3-1: Status indications of the LEDs

Total current of electronics supply exceeded



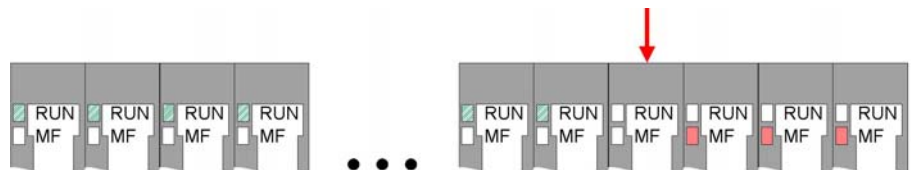
Reaction of the LEDs after switching on:	The RUN LEDs of all modules are off. The MF LEDs are only lighted on some modules.
Cause:	The total current for electronics supply exceeds the maximum current.
Remedy:	Plug in the power module art. no. 57131. For details, please see section Wiring .

Configuration error



Reaction of the LEDs after switching on:	The RUN LEDs are off on one or several modules. The MF LEDs are flashing on these modules.
Cause:	The module on which the MF LED is flashing, does not match the current configuration.
Remedy:	Match configuration and hardware structure.

Module failure



Reaction of the LEDs after switching on:	The RUN LEDs are flashing up to the module to the left of the defective module. On the following modules, the RUN LED is off. The MF LEDs are off up to the module to the left of the defective module. On the following modules, the MF LED is lit.
Cause:	The module to the right of the flashing modules is defective.
Remedy:	Replace the defective module.

3.7 Analog modules

3.7.1 General notes

Cables for analog signals



CAUTION!

Interference affects analog signals!

The measured values can be affected if they are transmitted via unshielded cables. Shielded cables reduce the interference.

→ Use shielded cables!

Grounding the shield

Cable ends with equal potential

→ Ground the shield of the analog cables on both cable ends.

Cable ends with potential difference

→ Ground the shield of the analog cables on one cable end.

There is no equipotential current which could interfere with the analog signals.

Transmitters

Depending on the module, the following transducers can be connected to the analog input modules:

- Current transmitters
- Voltage transmitters
- Resistance transmitters
- Temperature transmitters



CAUTION!

Reverse-poled connections of the transmitter!

The transmitter will be destroyed.

→ Connect the cables of the transmitter to the correct input poles.



CAUTION!

Interference signals on inputs not in use!

Unreliable measurements.

→ Short-circuit inputs not in use.

Short-circuiting

→ For each channel, connect the positive connection to the channel ground.

The inputs do not couple the interference signals any longer.

Parameterization

Parameterize via CPU, PROFIBUS and PROFINET using data records. The number of the data record can be found in the description of the module. This description also contains the indices (IX) or sub-indices (SX) for CANopen or for EtherCAT.

Diagnostic function

The modules are diagnosable.

The following error messages can be called using a diagnosis:

- Invalid parameter
- Measuring range exceeded/not reached
- Wire breakage

3.7.2 Analog value**Representation**

Analog values are processed only in binary form. For this, the analog module converts each process signal into a digital form and passes it on as word.

Resolution	Analog value															
	High byte (byte 0)								Low byte (byte 1)							
Bit number	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Significance	PM S	2^{14}	2^{13}	2^{12}	2^{11}	2^{10}	2^9	2^8	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
12 bit + PMS	PM S	Measured value												0	0	0
15 Bit + PMS	PM S	Measured value														

PMS = plus/minus sign

Resolution

With a resolution of 12 bit plus plus/minus bit, the not used low value positions (3 Bit) are filled with "0".

Plus/minus bit (PMS)

The following applies to the plus/minus bit: Bit 15 = 0 positive value Bit 15 = 1 negative value

Behavior at error

If a measured value exceeds the override range or does not reach the under-ride range, the following value is output:

Measured value > override range: 32767 (7FFFh),

Measured value < under-ride range: -32768 (8000h).

In case of parameterization error, the measured value 32767 (7FFFh) is output.

3.7.3 Measuring ranges

Voltage

Measuring range (function number)	Voltage (U)	Decimal (D)	Hex	Range	Conversion
-80 ... 80 mV Siemens S7 format (0x11)	94.07 mV	32511	0x7EFF	Override	$U = D * 80 / 27648$ $D = 27648 * U / 80$
	80 mV	27648	0x6C00	Nominal range	
	0 V	0	0x0000		
	-80 V	-27648	0x9400		
	-94.07 mV	-32511	0x8100	Underride	

Measuring range (function number)	Voltage (U)	Decimal (D)	Hex	Range	Conversion
-80 ... 80 mV Siemens S5 format (0x21)	100 mV	20480	0x5000	Override	$U = D * 80 / 16384$ $D = 16384 * U / 80$
	80 mV	16384	0x4000	Nominal range	
	0 V	0	0x0000		
	-80 mV	-16384	0xC000		
	-100 mV	-20480	0xB000	Underride	

Measuring range (Function number)	Voltage (U)	Decimal (D)	Hex	Range	Conversion
0 ... 10 V Siemens S7 format (0x10)	11.76 V	32511	0x7EFF	Override	$U = D * 10 / 27648$ $D = 27648 * U / 10$
	10 V	27648	0x6C00	Nominal range	
	5 V	13824	0x3600		
	0 V	0	0x0000		
	-1.76 V	-4864	0xED00	Underride	

Measuring range (Function number)	Voltage (U)	Decimal (D)	Hex	Range	Conversion
0 ... 10 V Siemens S5 format (0x20)	12.5	20480	0x5000	Override	$U = D * 10 / 16384$ $D = 16384 * U / 10$
	10 V	16384	0x4000	Nominal range	
	5 V	8192	0x2000		
	0 V	0	0x0000		
	-2 V	-3277	0xF333	Underride	

Measuring range (function number)	Voltage (U)	Decimal (D)	Hex	Range	Conversion
±10 V Siemens S7 format (0x12)	11.76	32511	0x7EFF	Override	$U = D * 10 / 27648$ $D = 27648 * U / 10$
	10 V	27648	0x6C00	Nominal range	
	5 V	13824	0x3600		
	0 V	0	0x0000		
	-5 V	-13824	0xCA00		
	-10 V	-27648	0x9400		
	-11.76	-32512	0x8100	Underride	

Measuring range (function number)	Voltage (U)	Decimal (D)	Hex	Range	Conversion
±10 V Siemens S5 format (0x22)	12.5	20480	0x5000	Override	$U = D * 10 / 16384$ $D = 16384 * U / 10$
	10 V	16384	0x4000	Nominal range	
	5 V	8192	0x2000		
	0 V	0	0x0000		
	-5 V	-8192	0xE000		
	-10 V	-16384	0xC000		
	-12.5	-20480	0xB000	Underride	

Current

Measuring range (function number)	Current (I)	Decimal (D)	Hex	Range	Conversion
0 ... 20 mA Siemens S7 format (0x31)	23.52 mA	32511	0x7EFF	Override	$D = 27648 * U / 20$ $I = D * 20 / 27648$
	20 mA	27648	0x6C00	Nominal range	
	10 mA	13824	0x3600		
	0 mA	0	0x0000		
	-3.52 mA	-4864	0xED00	Underride	
Measuring range (function number)	Current (I)	Decimal (D)	Hex	Range	Conversion
0 ... 20 mA Siemens S5 format (0x41)	25.00 mA	20480	0x5000	Override	$D = 16384 * I / 20$ $I = D * 20 / 16384$
	20 mA	16384	0x4000	Nominal range	
	10 mA	8192	0x2000		
	0 mA	0	0x0000		
	-4.00 mA	-3277	0xF333	Underride	
Measuring range (function number)	Current (I)	Decimal (D)	Hex	Range	Conversion
4 ... 20 mA Siemens S7 format (0x30)	22.81 mA	32511	0x7EFF	Override	$D = 27648 * I - 4 / 16$ $I = D * 16 / 27648 + 4$
	20 mA	27648	0x6C00	Nominal range	
	12 mA	13824	0x3600		
	4 mA	0	0x0000		
	1.19 mA	-4864	0xED00	Underride	
Measuring range (function number)	Current (I)	Decimal (D)	Hex	Range	Conversion
4 ... 20 mA Siemens S5 format (0x40)	24.00 mA	20480	0x5000	Override	$D = 16384 * I - 4 / 16$ $I = D * 16 / 16384 + 4$
	20 mA	16384	0x4000	Nominal range	
	12 mA	8192	0x2000		
	4 mA	0	0x0000		
	0.8 mA	-3277	0xF333	Underride	
Measuring range (function number)	Current (I)	Decimal (D)	Hex	Range	Conversion
0 ... 20 mA 4 KM format (0x3F)	20.457 mA	4095	0x0FFF	Override	$D = 4000 * I / 20$ $I = D * 20 / 4000$
	20 mA	4000	0x0FA0	Nominal range	
	10 mA	2000	0x07D0		
	0 mA	0	0x0000		
	-	-	-	Underride	

Temperature

Temperature measure- ment Type J

Measuring range	Measured value [°C] (0.1 °C/digit)	Measured value [°F] (0.1 °F/digit)	Measured value [K] (0.1 K/digit)	Range
-210 ... 1200 °C	14500	26420	17232	Override
-346 ... 2192 °F	-2100 ... 12000	-3460 ... 21920	632 ... 14732	Nominal range
63.2 ... 1473.2 K	- - -	- - -	- - -	Underride

Temperature measure- ment Type K

Measuring range	Measured value [°C] (0.1 °C/digit)	Measured value [°F] (0.1 °F/digit)	Measured value [K] (0.1 K/digit)	Range
-270 ... 1372 °C	16220	29516	18952	Override
-454 ... 2501.6 °F	-2700 ... 13720	-4540 ... 25016	0 ... 16452	Nominal range
0 ... 1645.2 K	- - -	- - -	- - -	Underride

**Temperature measurement
Type N**

Measuring range	Measured value [°C] (0.1 °C/digit)	Measured value [°F] (0.1 °F/digit)	Measured value [K] (0.1 K/digit)	Range
-270 ... 1300° C	15500	28220	18232	Override
-454 ... 2372 °F	-2700 ... +13000	-4540 ... 23720	0 ... 15732	Nominal range
0 ... 1573.2 K	- - -	- - -	- - -	Underride

**Temperature measurement
Type R**

Measuring range	Measured value [°C] (0.1 °C/digit)	Measured value [°F] (0.1 °F/digit)	Measured value [K] (0.1 K/digit)	Range
-50 ... 1769° C	20190	32766	22922	Override
-58 ... 3216.2 °F	-500 ... 17690	-580 ... 32162	2232 ... 20422	Nominal range
223.2...2042.2 K	-1700	- 2740	1032	Underride

**Temperature measurement
Type S**

Measuring range	Measured value [°C] (0.1 °C/digit)	Measured value [°F] (0.1 °F/digit)	Measured value [K] (0.1 K/digit)	Range
-50 ... 1769° C	20190	32766	22922	Override
-58 ... 3216.2 °F	-500 ... 17690	-580 ... 32162	2232 ... 20422	Nominal range
223.2...2042.2 K	- 1700	- 2740	-1032	Underride

**Temperature measurement
Type T**

Measuring range	Measured value [°C] (0.1 °C/digit)	Measured value [°F] (0.1 °F/digit)	Measured value [K] (0.1 K/digit)	Range
-270 ... 400° C	5400	10040	8132	Override
-454 ... 752 °F	-2700 ... 4000	-4540 ... 7520	32 ... 6732	Nominal range
3.2 ... 673.2 K	- - -	- - -	- - -	Underride

**Temperature measurement
Type B**

Measuring range	Measured value [°C] (0.1 °C/digit)	Measured value [°F] (0.1 °F/digit)	Measured value [K] (0.1 K/digit)	Range
0 ... +1820° C	20700	32766	23432	Override
32 ... 2786.5 °F	0 ... +18200	320 ... 27865	2732 ... 20932	Nominal range
273.2...2093.2K	- 1200	-1840	1532	Underride

**Temperature measurement
Type C**

Measuring range	Measured value [°C] (0.1 °C/digit)	Measured value [°F] (0.1 °F/digit)	Measured value [K] (0.1 K/digit)	Range
0 ... 2315° C	25000	32766	23432	Override
32 ... 2786.5 °F	0 ... 23150	320 ... 27865	2732 ... 20932	Nominal range
273.2...2093.2K	- 1200	-1840	1532	Underride

**Temperature measurement
Type E**

Measuring range	Measured value [°C] (0.1 °C/digit)	Measured value [°F] (0.1 °F/digit)	Measured value [K] (0.1 K/digit)	Range
-270 ... 1000° C	12000	21920	14732	Override
-454 ... 1832 °F	-2700 ... 10000	-4540 ... 18320	0 ... 12732	Nominal range
0...1273.2 K	- - -	- - -	- - -	Underride

**Temperature measurement
Type L**

Measuring range	Measured value [°C] (0.1 °C/digit)	Measured value [°F] (0.1 °F/digit)	Measured value [K] (0.1 K/digit)	Range
-200 ... 900° C	11500	21020	14232	Override
-328 ... 1652 °F	-2000 ... 9000	-3280 ... 16520	732 ... 11732	Nominal range
73.2 ... 1173.2 K	- - -	- - -	- - -	Underride

Resistance

Sensor: PT100, PT1000

Technology	Sensor	Function number
2-wire	PT100	0x50
	PT1000	0x51
3-wire	PT100	0x58
	PT1000	0x59
4-wire	PT100	0x60
	PT1000	0x61

Measuring range:

Measured value [°C]	Measured value [°F]	Signal range	Range
+1,000	1,832	+10,000	Override
-200 ... +850	-328 ... 1,562	-2,000 ... +8,500	Nominal range
-243	-405.4	-2,430	Underride

Sensor: NI100, NI1000

Technology	Sensor	Function number
2-wire	NI100	0x52
	NI1000	0x53
3-wire	NI100	0x5A
	NI1000	0x5B
4-wire	NI100	0x62
	NI1000	0x63

Measuring range:

Measured value [°C]	Measured value [°F]	Signal range	Range
+295	+563	+2,950	Override
-60 ... +250	--76 ... +482	-600 ... +2,500	Nominal range
-105	-157	-1,050	Underride

Signal range
0 ... 32,767

Technology	Resistance range [Ω]	Function number
2-wire	0 ... 60	0x70
	0 ... 600	0x71
	0 ... 3,000	0x72
3-wire	0 ... 60	0x78
	0 ... 600	0x79
	0 ... 3,000	0x7A
4-wire	0 ... 60	0x80
	0 ... 600	0x81
	0 ... 3,000	0x82

Measuring range:

Measured value [Ω]	Signal range	Range
---	---	Override
0 ... 60	0 ... 3,276	Nominal range
0 ... 600		
0 ... 3,000		
---	---	Underride

Signal range
0 ... 6,000/0 ... 30,000

Technology	Resistance range [Ω]	Function number
2-wire	0 ... 60	0x90
	0 ... 600	0x11
	0 ... 3,000	0x92

Technology	Resistance range [Ω]	Function number
3-wire	0 ... 60	0x98
	0 ... 600	0x99
	0 ... 3,000	0x9A
4-wire	0 ... 60	0xA0
	0 ... 600	0xA1
	0 ... 3,000	0xA2

Measuring range:

Measured value [Ω]	Signal range	Range
---	---	Override
0 ... 60	0 ... 6,000	Nominal range
0 ... 600	0 ... 6,000	
0 ... 3,000	0 ... 30,000	
---	---	Underride

Signal range
0 ... 27,648

Technology	Resistance range [Ω]	Function number
2-wire	0 ... 60	0xD0
	0 ... 600	0xD1
	0 ... 3,000	0xD2
3-wire	0 ... 60	0xD8
	0 ... 600	0xD9
	0 ... 3,000	0xDA
4-wire	0 ... 60	0xE0
	0 ... 600	0xE1
	0 ... 3,000	0xE2

Measuring range

Resistance range [Ω]	Measured value [W]	Signal range	Range
0 ... 60	70.55	32,511	Override
	0 ... 60	0 ... 27,648	Nominal range
	---	---	Underride
0 ... 600	705.5	32,511	Override
	0 ... 600	0 ... 27,648	Nominal range
	---	---	Underride
0 ... 3,000	3,528	32,511	Override
	0 ... 3,000	0 ... 27,648	Nominal range
	---	---	Underride

3.8 Art. no. 57262 AI 4x16 Bit 0 (4) ... 20 mA

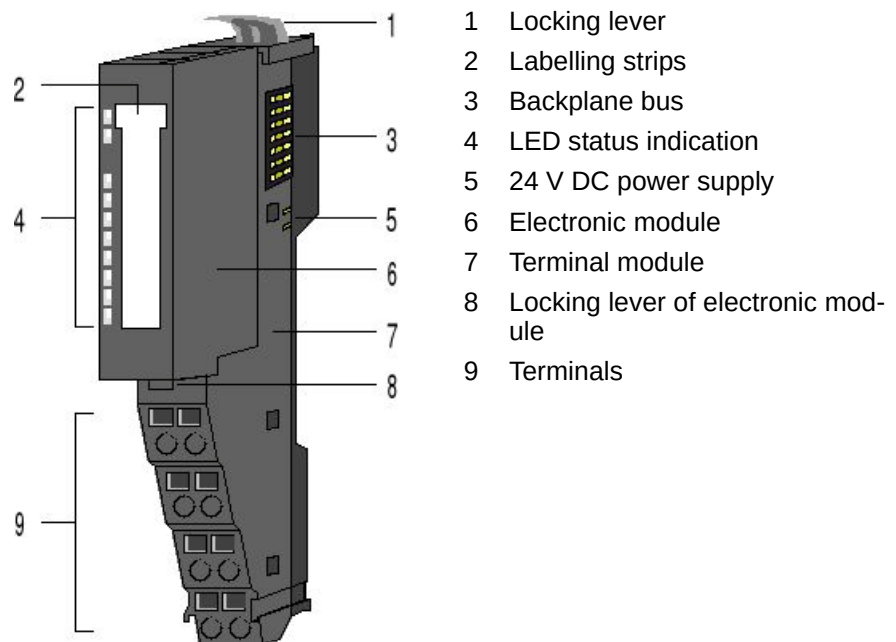
Description

The electronic module has 4 inputs, its functions can be parameterized. The channels on the module are electrically isolated from the backplane bus. Additionally, the channels are electrically isolated by a DC/DC converter from the 24 V DC power supply.

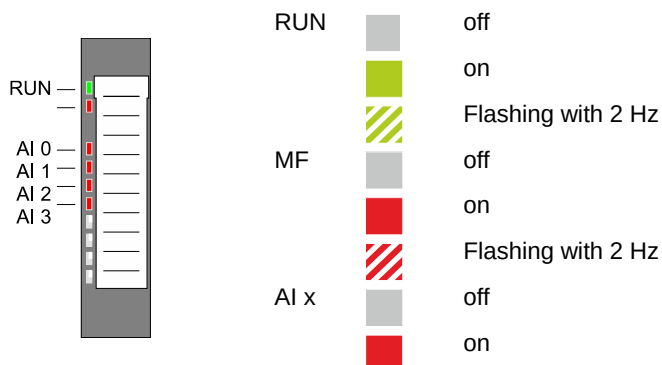
Properties

- 4 analog inputs
- Suitable for transmitters with 0 ... 20 mA; 4 ... 20 mA with external power supply
- Resolution: 16 Bit

Design



Status indication

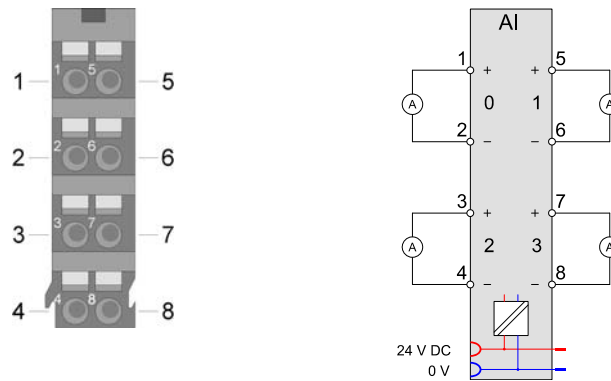


RUN	MF	AI x	Description
			Bus communication is OK Module status is OK
			Bus communication is OK Module status reports error
			Bus communication is not possible Module status reports error
			Error of bus supply voltage
			Configuration error (see 3.6 Troubleshooting - LEDs, Seite 26)
			Error of channel x - Overload, short circuit - Error in the parameterization

Tab. 3-2: Status indications of the LEDs

Terminal

➔ Connect the wires with a cross-section of 0.08 mm² to 1.5 mm².



Pos.	Function	Type	Description
1	+AI 0	Input	+ channel 0
2	-AI 0	Input	Ground of channel 0
3	+AI 2	Input	+ channel 2
4	-AI 2	Input	Ground of channel 2
5	+AI 1	Input	+ channel 1
6	-AI 1	Input	Ground of channel 1
7	+AI 3	Input	+ channel 3
8	-AI 3	Input	Ground of channel 3

Tab. 3-3: Terminal assignment

Input/output range

In CPU, PROFIBUS and PROFINET the input and output range is displayed in the corresponding address range. Information on access to the CUBE20S system is given in the manual of the corresponding bus node.

- IX = index for access via CANopen with s = Subindex, depending on the number and type of the analog modules.
- SX = Subindex for access via EtherCAT.

Input range

Addr.	Name	Bytes	Function	IX	SX
+0	AI 0	2	Analog value of channel 0	0x6401/s	0x01
+2	AI 1	2	Analog value of channel 1	0x6401/s+1	0x02
+4	AI 2	2	Analog value of channel 2	0x6401/s+2	0x03
+6	AI 3	2	Analog value of channel 3	0x6401/s+3	0x04

Output range

No bytes reserved for the module in the output range.

Parameterization data

DS	Data record for access using CPU, PROFIBUS and PROFINET
IX	Index for access using CANopen.
SX	Subindex for access via EtherCAT

Name	Bytes	Function	Default	DS	IX	SX
DIAG	1	Diagnosis	0x00	0x00	0x3100	0x01
RES1	1	reserved	0x00	0x00	0x3101	0x02
LIMIT_EN	1	Limit value monitoring	0x00	0x00	0x3102	0x03
SUPR	1	Interference frequency suppression	0x00	0x01	0x3103	0x04
CH0FN	1	Function number of channel 0	0x31	0x80	0x3104	0x05
RES7	1	reserved	0x00	0x80	0x3105	0x06
CH0UL	2	Upper limit value of channel 0	0x7FFF	0x80	0x3106 ... 0x3107	0x07
CH0LL	2	Lower limit value of channel 0	0x8000	0x80	0x3108 ... 0x3109	0x08
CH1FN	1	Function number of channel 1	0x31	0x81	0x310A	0x09
RES13	1	reserved	0x00	0x81	0x310B	0x0A
CH1UL	2	Upper limit value of channel 1	0x7FFF	0x81	0x310C ... 0x310D	0x0B
CH1LL	2	Lower limit value of channel 1	0x8000	0x81	0x310E ... 0x310F	0x0C
CH2FN	1	Function number of channel 2	0x31	0x82	0x3110	0x0D
RES19	1	reserved	0x00	0x82	0x3111	0x0E
CH2UL	2	Upper limit value of channel 2	0x7FFF	0x82	0x3112 ... 0x3113	0x0F
CH2LL	2	Lower limit value of channel 2	0x8000	0x82	0x3114 ... 0x3115	0x10
CH3FN	1	Function number of channel 3	0x31	0x83	0x3116	0x11
RES25	1	reserved	0x00	0x83	0x3117	0x12
CH3UL	2	Upper limit value of channel 3	0x7FFF	0x83	0x3118 ... 0x3119	0x13
CH3LL	2	Lower limit value of channel 3	0x8000	0x83	0x311A ... 0x311B	0x14

 DIAG
 Diagnosis

Byte	Bit 7 ... 0	Description
0	Bit 5 ... 0	reserved
	Bit 6	Diagnostic interrupt
	1	enabled
	Bit 7	reserved

 LIMIT_EN
 Limit value monitoring

Byte	Bit 7 ... 0	Description
0	Bit 0	Limit value monitoring of channel 0
	1	on
	Bit 1	Limit value monitoring of channel 1
	1	on
	Bit 2	Limit value monitoring of channel 2
	1	on
	Bit 3	Limit value monitoring of channel 3
	1	on
	Bit 7 ... 4	reserved

 SUPR
 Interference frequency suppression

Byte	Bit 7 ... 0	Description
0	Bit 1, 0	Interference frequency suppression of channel 0
	Bit 3, 2	Interference frequency suppression of channel 1
	Bit 5, 4	Interference frequency suppression of channel 2
	Bit 7, 6	Interference frequency suppression of channel 3

00 deactivated

01 60 Hz

10 50 Hz

Example

10101010

For all channels, the interference frequency suppression is 50 Hz

CHxFN

Function number of
channel x

Below you will find all measuring ranges with the corresponding function number which are supported by this module.

Using the formulas calculate from the determined measured value (digital value) a value (analog value) assigned to the measuring range and vice versa.

Deactivating channel

➔ Enter 0xFF.

Measuring range (function number)	Current (I)	Decimal (D)	Hex	Range	Conversion
0 ... 20 mA Siemens S7 format (0x31)	23.52 mA	32511	0x7EFF	Override	$D = 27648 * U / 20$ $I = D * 20 / 27648$
	20 mA	27648	0x6C00	Nominal range	
	10 mA	13824	0x3600		
	0 mA	0	0x0000		
	-3.52 mA	-4864	0xED00	Underride	

Measuring range (function number)	Current (I)	Decimal (D)	Hex	Range	Conversion
0 ... 20 mA Siemens S5 format (0x41)	25.00 mA	20480	0x5000	Override	$D = 16384 * I / 20$ $I = D * 20 / 16384$
	20 mA	16384	0x4000	Nominal range	
	10 mA	8192	0x2000		
	0 mA	0	0x0000		
	-4.00 mA	-3277	0xF333	Underride	

Measuring range (function number)	Current (I)	Decimal (D)	Hex	Range	Conversion
4 ... 20 mA Siemens S7 format (0x30)	22.81 mA	32511	0x7EFF	Override	$D = 27648 * I - 4 / 16$ $I = D * 16 / 27648 + 4$
	20 mA	27648	0x6C00	Nominal range	
	12 mA	13824	0x3600		
	4 mA	0	0x0000		
	1.19 mA	-4864	0xED00	Underride	

Measuring range (function number)	Current (I)	Decimal (D)	Hex	Range	Conversion
4 ... 20 mA Siemens S5 format (0x40)	24.00 mA	20480	0x5000	Override	$D = 16384 * I - 4 / 16$ $I = D * 16 / 16384 + 4$
	20 mA	16384	0x4000	Nominal range	
	12 mA	8192	0x2000		
	4 mA	0	0x0000		
	0.8 mA	-3277	0xF333	Underride	

CHxUL

CHxLL

Upper limit value

Lower limit value
of channel xYou can define an *upper* resp. *lower limit value* for each channel, whereas only values from the nominal range are permitted. Otherwise, you get a parameterization error.

A process interrupt is triggered if

- the limit value monitoring is activated **and**
- the measured value is beyond one of the limit values.

Deactivating limit value

➔ Enter 0x7FFF for the upper limit value.

➔ Enter 0x8000 for the lower limit value.

Diagnosis and interrupt

Trigger	Process interrupt	Diagnostic interrupt	can be parameterized
Planning/ Parameterization error	-	x	-

Trigger	Process interrupt	Diagnostic interrupt	can be parameterized
Overrange	-	x	-
Underrange	-	x	-
Limit value overrange	x	-	x
Limit value underrange	x	-	x
Overflow of diagnosis buffer	-	x	-
Communication error	-	x	-
Process interrupt lost	-	x	-

Process interrupt data

Activate the process interrupts in order to respond to asynchronous events. A process interrupt stops the linear program sequence and branches depending on the master system into a certain interrupt routine. Here you can respond correspondingly to the process interrupt.

CANopen transmits the process interrupt data in an Emergency telegram.

When accessing using CPU, PROFIBUS and PROFINET, they transmit this process interrupt data in a diagnostic telegram.

SX = Subindex for access via EtherCAT.

Name	Bytes	Function	Default	SX
PRIT_OL	1	Limit value overrange of channel x	0x00	0x02
PRIT_UL	1	Limit value underrange of channel x	0x00	0x03
PRIT_US	2	µs ticker	0x00	0x04 ... 0x05

PRIT_OL
Limit value
overrange

Byte	Bit 7 ... 0	Description
0	Bit 0	Limit value overrange of channel 0
	Bit 1	Limit value overrange of channel 1
	Bit 2	Limit value overrange of channel 2
	Bit 3	Limit value overrange of channel 3
	Bit 7 ... 4	reserved

PRIT_UL
Limit value underrange

Byte	Bit 7 ... 0	Description
0	Bit 0	Limit value underrange of channel 0
	Bit 1	Limit value underrange of channel 1
	Bit 2	Limit value underrange of channel 2
	Bit 3	Limit value underrange of channel 3
	Bit 7 ... 4	reserved

PRIT_US
µs ticker

Byte	Bit 7 ... 0	Description
0 ... 1		Value of the µs ticker at the moment of the process interrupt

PRIT_US represents the lower 2 Bytes of the µs-ticker value ($0 \dots 2^{16}-1$).

**µs ticker**

There is a timer (µs ticker) in the module, it is started by means of PowerON and starts counting from 0 after $2^{32}-1$ µs.

Diagnostic data

Using Parameterization activate a diagnostic interrupt for the module.

Function

- Upon triggering of a diagnostic interrupt, the module provides *incoming* diagnosis data for diagnosis.
- As soon as the reasons for triggering of a diagnosis interrupt are no longer present, you receive an *outgoing* diagnostic interrupt automatically.
- If an *incoming* diagnostic interrupt has been triggered for a channel due to Process interrupt lost, all events up to a certain *outgoing* diagnostic interrupt will be lost.
- The MF-LED of the module is lit during this period (from the 1st *incoming* diagnostic interrupt until the last *outgoing* diagnostic interrupt).

Errors

The following errors are registered in the diagnostic data:

- Planning / Parameterization errors
- Overrange
- Underrange
- Process interrupt lost
- Supply voltage missing

Diagnosis

- DS Data record for access using CPU, PROFIBUS and PROFINET
Access using DS 0x01.
Besides, you can access the first 4 Bytes using DS 0x00.
- IX Index for access using CANopen.
Access using IX 0x2F01.
Besides, you can access the first 4 Bytes using IX 0x2F00.
- SX Subindex for access via EtherCAT.

Name	Bytes	Function	Default	DS	IX	SX
ERR_A	1	Diagnosis	0x00	0x01	0x2F01	0x02
MODTYP	1	Module information	0x15			0x03
ERR_C	1	reserved	0x00			0x04
ERR_D	1	Diagnosis	0x00			0x05
CHTYP	1	Channel type	0x71			0x06
NUMBIT	1	No. of diagnostic bits per channel	0x08			0x07
NUMCH	1	Number of channels of the module	0x04			0x08
CHERR	1	Channel error	0x00			0x09
CH0ERR	1	Channel-specific error of channel 0	0x00			0x0A
CH1ERR	1	Channel-specific error of channel 1	0x00			0x0B
CH2ERR	1	Channel-specific error of channel 2	0x00			0x0C
CH3ERR	1	Channel-specific error of channel 3	0x00			0x0D
CH4ERR ... CH7ERR	4	reserved	0x00			0x0E ... 0x11
DIAG_US	4	µs ticker	0x00			0x12

ERR_A Diagnosis

Byte	Bit 7 ... 0	Description
0	Bit 0	set in case of Assembly fault
	Bit 1	set in case of Internal error
	Bit 2	set in case of External error
	Bit 3	set in case of Channel error available
	Bit 4	set in case of Missing external power supply
	Bit 5, 6	reserved
	Bit 7	set in case of Invalid parameter

MODTYP
Module information

Byte	Bit 7 ... 0	Description
0	Bit 3 ... 0	Module class 0101 Analog module
	Bit 4	set in case of Channel information available
	Bit 7 ... 5	reserved

ERR_D
Diagnosis

Byte	Bit 7 ... 0	Description
0	Bit 2 ... 0	reserved
	Bit 3	set in case of Internal diagnosis buffer overflow
	Bit 4	set in case of Internal communication error
	Bit 5	reserved
	Bit 6	set in case of Process interrupt lost
	Bit 7	reserved

CHTYP
Channel type

Byte	Bit 7 ... 0	Description
0	Bit 6 ... 0	Channel type 0x71 Analog input
	Bit 7	reserved

NUMBIT
Diagnostic bits

Byte	Bit 7 ... 0	Description
0		Number of diagnostic bits of the module per channel (here 0x08)

NUMCH
Channels

Byte	Bit 7 ... 0	Description
0		Number of channels of a module (here 0x04)

CHERR
Channel error

Byte	Bit 7 ... 0	Description
0	Bit 0	set in case of Error of channel group 0
	Bit 1	set in case of Error of channel group 1
	Bit 2	set in case of Error of channel group 2
	Bit 3	set in case of Error of channel group 3
	Bit 7 ... 4	reserved

CH0ERR
CH3ERR
channel-specific

Byte	Bit 7 ... 0	Description
0	Channel-specific errors: channel x	
	Bit 0	set in case of Planning / Parameterization errors
	Bit 4 ... 1	reserved
	Bit 5	set in case of Process interrupt lost
	Bit 6	set in case of Underrange
	Bit 7	set in case of Overrange

CH4ERR ... CH7ERR
reserved

Byte	Bit 7 ... 0	Description
0		reserved

DIAG_US
µs ticker

Byte	Bit 7 ... 0	Description
0 ... 3		Value of the µs ticker at the moment of the diagnosis



µs ticker

There is a timer (µs ticker) in the module, it is started by means of PowerON and starts counting from 0 after $2^{32}-1$ µs.

4 General data

Conformity		
CE	2006/95/EC	Low voltage directive
	2004/108/EC	EMC Directive
	2011/65/EU	RoHS

Personal and device protection		
Ingress protection	EN 60529	IP20
Electric isolation		
To fieldbus	-	DC-isolated
To process level	-	DC-isolated
Dielectric strength	EN 61131-2	-
Insulation voltage to ground		
Inputs / outputs	-	50 V AC/DC, with test voltage 500 V AC
Protective measures	-	against short-circuit

Ambient conditions		
Climatic		
Storage / transport	EN 60068-2-14	-25 ... +70 °C
Operation		
Horizontal installation	EN 61131-2	0 ... +60 °C
Vertical installation	EN 61131-2	0 ... +60 °C
Humidity	EN 60068-2-30	RH1 (without condensation, relative humidity 10 ... 95 %)
Pollution	EN 61131-2	Pollution degree 2
Mechanical		
Vibration	EN 60068-2-6	1 g, 9 Hz ... 150 Hz
Shock	EN 60068-2-27	15 g, 11 ms

Installation conditions		
Place of installation	-	Inside the switch cabinet
Installation position	-	Horizontal and vertical
Fastening	-	35 mm DIN rail

EMC	Standard	Notes
Emitted interference	EN 61000-6-4	Class A (industrial environments)
Immunity Zone B	EN 61000-6-2	Industrial environments
	EN 61000-4-2	ESD 8 kV with air discharge (severity grade 3), 4 kV with contact discharge (severity grade 2)
	EN 61000-4-3	HF irradiation (housing) 80 MHz ... 1000 MHz, 10 V/m, 80 % AM (1 kHz) 1.4 GHz ... 2.0 GHz, 3 V/m, 80 % AM (1 kHz) 2 GHz ... 2.7 GHz, 1 V/m, 80 % AM (1 kHz)
	EN 61000-4-6	conducted 150 kHz ... 80 MHz, 10 V, 80 % AM (1 kHz)
	EN 61000-4-4	Burst, severity grade 3
	EN 61000-4-5	Surge, installation class 3 *)

*) Due to single high-energy impulses, a suitable external wiring with lightning protection elements is required for surge, e.g. lightning arresters and surge arrester.

Mechanical data	
Housing	
Material	PPE / PPE GF10
Dimensions (W x H x D)	48.5 x 109 x 76.5 mm

Mechanical data	
Housing	
Weight	155 g

5 Technical data

Power consumption / power dissipation	
Power consumption from the backplane bus	60 mA
Power dissipation	0.7 W
Analog inputs	
Number of inputs	4
Cable length shielded	200 m
On-load nominal voltage	24 V DC
Power consumption from on-load voltage L+ (without load)	20 mA
Voltage inputs	-
min. input resistance within voltage range	-
Input voltage ranges	-
Operational limit of voltage ranges	-
Operational limit of voltage range with SFU	-
Basic error limit of voltage ranges	-
Basic error limit of voltage ranges with SFU	-
Current inputs	yes
max. input resistance within current range	60 Ω
Input current ranges	0 mA...+20 mA +4 mA...+20 mA
Operational limit of current ranges	± 0.2 %
Operational limit of current ranges with SFU	-
Basic error limit of current ranges	± 0.1 %
Basic error limit of current ranges with SFU	-
Resistance inputs	-
Resistance ranges	-
Operational limit of resistance ranges	-
Basic error limit of resistance ranges	-
Resistance thermometer inputs	-
Resistance thermometer ranges	-
Operational limit of resistance thermometer ranges	-
Operational limit of resistance ranges with SFU	-
Basic error limit of resistance thermometer ranges	-
Operational limit of resistance ranges with SFU	-
Thermocouple inputs	-
Thermocouple ranges	-
Operational limit of thermocouple ranges	-
Operational limit of thermocouple ranges with SFU	-
Basic error limit of thermocouple ranges	-
Basic error limit of thermocouple ranges with SFU	-
Temperature compensation can be parameterized	-
Temperature compensation external	-
Temperature compensation internal	-
Resolution in bits	16
Measuring principle	successive approximation
Basic conversion time	480 μ s all channels
Noise suppression for frequency	>80 dB at 50 Hz (U _{CM} <4 V)
Status, interrupt, diagnoses	
Status indication	yes
Interrupts	yes, programmable
Process interrupt	yes, programmable
Diagnostic interrupt	yes, programmable

Status, interrupt, diagnoses

Diagnostic function	yes
Diagnosis information readable	possible
Module status	Green LED
Module error	Red LED
Channel error	red LED per channel

Electrical isolation

between the channels	-
between the channels in groups of	-
between the channels and backplane bus	yes
between the channels and power supply	yes
max. potential difference between the circuits	-
max. potential difference between the inputs (Ucm)	4 V DC
max. potential difference between Mana and Mintern (Uiso)	-
max. potential difference between the inputs and Mana (Ucm)	-
max. potential difference between the inputs and Mintern (Uiso)	75 V DC / 60 V AC
max. potential difference between Mintern and outputs	-
Insulation tested with	500 V DC

Data sizes

Input bytes	4
Output bytes	0
Parameter bytes	32
Diagnosis bytes	20

Mechanical data

Housing

Material	PPE / PPE GF10
Dimensions (W x H x D)	12.9 x 109 x 76.5 mm
Weight	60 g

Ambient conditions

Operating temperature	0 °C to 60 °C
Storage temperature	-25 °C to 70 °C

Certifications

Certification according to UL 508	yes
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6 Annex

6.1 Accessories

Carrier for shield busses

The shield busses (10 mm x 3 mm) to connect cable shields are fastened on the carrier.



NOTE

Carriers for shield busses, shield busses and cable shield fasteners are not included in the delivery.

Installing the carrier

- ✓ Prerequisite: The Cube20S system has been completely mounted.
- ➔ If the DIN rail is flat, break the spacer off the carrier.
- ➔ Plug the carrier in the terminal module below the terminal block until it engages.

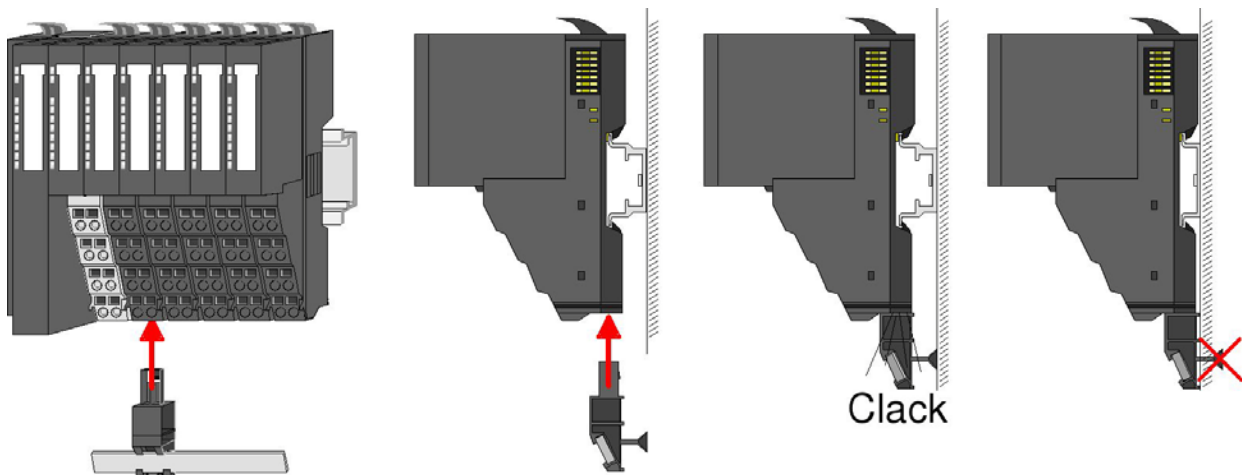


Fig. 6-1: Installing the carriers for shield busses

6.2 Legal information

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6.3 Versioning

Version	1.0
Date	2013-03-10
Chapter	-
Modifications	new

